What is claimed is:

1. A method for carrier tracking and spread spectrum code tracking in a spread spectrum communication system, the method comprising the steps of,

receiving a spread spectrum input signal having inphase and quadrature components communicating a spread spectrum code modulating a carrier,

carrier generating quadrature demodulation signals referenced to a local reference, the quadrature demodulation signals having a carrier phase referenced to the carrier,

demodulating the spread spectrum input signal by the quadrature demodulation signals for generating the inphase and quadrature components,

code generating early and late code replicas of the spread spectrum code, the early and late code replicas having a code phase referenced to the spread spectrum code,

correlating the inphase and quadrature components by the early and late code replicas for generating early and late inphase and quadrature correlation signals,

residual generating a residual from the early and late inphase an quadrature correlation signals and from a code phase error state and a amplitude state and a carrier phase error state and frequency error state,

calculating a code phase error and an amplitude and a carrier phase error and a carrier frequency error from the residual and a state error covariance matrix and the code phase error state and the amplitude state and the carrier phase error state and the frequency error state,

propagating the code phase error state and the amplitude state and the carrier phase error state and the carrier frequency error state from the code phase error and the amplitude and the carrier phase error and the carrier frequency error,

Riccati estimating the state error covariance matrix from the code phase error state and the amplitude state,

carrier phase adjusting the quadrature demodulation signals by the carrier phase error for reducing the carrier phase between the carrier and the quadrature demodulation signals for tracking the carrier, and

code phase adjusting the early and late code replicas by the code phase error for reducing the code phase between the spread spectrum code and early and late code replicas for tracking the spread spectrum code.

2. The method of claim 1 wherein,

the state error covariance matrix is a Riccati state error covariance matrix P defined by an algebraic Riccati equation of the form $0=AP+P^TA+W-Ph^TV^{-1}hP$ where A is a state dynamics matrix, V^{-1} is an inverse observation covariance, h is a linearized observation matrix, h^T is a transposed linearized observation matrix, and W is a state covariance.

3. The method of claim 1 wherein the communication system is a GPS receiver and the code phase error is a range error.

4. The method of claim 1 wherein,

the spread spectrum input signal is a GPS spread spectrum signal,

the local reference is a local oscillator for coherent demodulation of the spread spectrum input signal, and

the spread spectrum code is a direct sequence spread spectrum code.

5. The method of claim 1 wherein the code phase error state and the amplitude state are assigned constant nominal values during the estimating step.

6. The method of claim 1 further comprising the steps of,

transmitter calculating a transmitter position and a transmitter velocity from the spread spectrum input signals,

receiver calculating a receiver position and a receiver velocity from the early and late inphase and quadrature correlation signals,

range calculating a range and a range rate from the transmitter and receiver positions and velocities, the range rate further adjusting the quadrature demodulation signals for reducing the carrier phase between the carrier and the quadrature demodulation signals for tracking the carrier, the range further adjusting the early and late code replicas for reducing the code phase between the spread spectrum code and early and late code replicas for tracking the spread spectrum code.

7. The method of claim 1 wherein,

the calculating step further calculates a carrier frequency rate error,

the propagating step further propagates a carrier frequency rate error state, and

the residual generating step generates the residual from the early and late inphase quadrature correlation signals and from the code phase error state and the amplitude state and the carrier phase error state and the carrier frequency error state.

8. The method of claim 1 wherein the residual generating step and the calculating step and the propagating step and the Riccati estimating step are a Kalman prefiltering process in a spread spectrum receiver in the spread spectrum communication system.

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9. A method for carrier tracking and spread spectrum code tracking in a GPS navigation processor in a GPS spread spectrum receiver, the method comprising the steps of,

receiving the GPS spread spectrum input signal having inphase and quadrature components communicating a spread spectrum code modulating a carrier,

carrier generating quadrature demodulation signals referenced to a local reference, the quadrature demodulation signals having a carrier phase referenced to the carrier,

demodulating the GPS spread spectrum input signal by the quadrature demodulation signals for generating the inphase and quadrature components,

code generating early and late code replicas of the spread spectrum code, the early and late code replicas having a code phase referenced to the spread spectrum code,

correlating the inphase and quadrature components by the early and late code replicas for generating early and late inphase and quadrature correlation signals,

residual generating a residual from the early and late inphase an quadrature correlation signals and from a code phase error state and a amplitude state and a carrier phase error state and frequency error state,

calculating a code phase error and an amplitude and a carrier phase error and a carrier frequency error from the residual and a state error covariance matrix and the code phase error state and the amplitude state and the carrier phase error state and the frequency error state,

propagating the code phase error state and the amplitude state and the carrier phase error state and the carrier frequency error state from the code phase error and the amplitude and the carrier phase error and the carrier frequency error,

Riccati estimating the state error covariance matrix from the code phase error state and the amplitude state,

navigation calculating a receiver position and a receiver velocity from the early and late inphase and quadrature correlation signals,

satellite calculating a satellite position and a satellite velocity from the GPS spread spectrum input signal,

range calculating a pseudorange and a pseudorange rate from the receiver and satellite positions and velocities,

carrier phase adjusting the quadrature demodulation signals from the pseudorange rate and by the carrier phase error for reducing the carrier phase between the carrier and the quadrature demodulation signals for tracking the carrier, and

code phase adjusting the early and late code replicas from the pseudorange and by the code phase error for reducing the code phase between the spread spectrum code and early and late code replicas for tracking the spread spectrum code.

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10. The method of claim 9 wherein,

the navigation calculating step further calculates clock error estimates, and

the range calculating step calculates the pseudorange and the pseudorange rate from the receiver and satellite positions and velocities and from the clock error estimates.

11. The method of claim 9 wherein the residual generating step and the calculating step and the propagating step and the Riccati estimating step are a Kalman prefiltering process in the GPS spread spectrum receiver.

12. The method of claim 9 wherein,

the state error covariance matrix is a Riccati state error covariance matrix P defined by an algebraic Riccati equation of the form $0=AP+P^TA+W-Ph^TV^{-1}hP$ where A is a state dynamics matrix, V^{-1} is an inverse observation covariance, h is a linearized observation matrix, h^T is a transposed linearized observation matrix, and W is a state covariance.

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13. A method for carrier tracking and spread spectrum code tracking in an inertial GPS navigation processor in a GPS spread spectrum receiver receiving inertial measurement samples, the method comprising the steps of,

receiving the GPS spread spectrum input signal having inphase and quadrature components communicating a spread spectrum code modulating a carrier,

carrier generating quadrature demodulation signals referenced to a local reference, the quadrature demodulation signals having a carrier phase referenced to the carrier,

demodulating the GPS spread spectrum input signal by the quadrature demodulation signals for generating the inphase and quadrature components,

code generating early and late code replicas of the spread spectrum code, the early and late code replicas having a code phase referenced to the spread spectrum code,

correlating the inphase and quadrature components by the early and late code replicas for generating early and late inphase and quadrature correlation signals,

residual generating a residual from the early and late inphase an quadrature correlation signals and from a code phase error state and a amplitude state and a carrier phase error state and frequency error state,

calculating a code phase error and an amplitude and a carrier phase error and a carrier frequency error from the residual and a state error covariance matrix and the code phase error state and the amplitude state and the carrier phase error state and the frequency error state,

propagating the code phase error state and the amplitude state and the carrier phase error state and the carrier frequency error state from the code phase error and the amplitude and the carrier phase error and the carrier frequency error,

Riccati estimating the state error covariance matrix from the code phase error state and the amplitude state,

integrating the amplitude and the code phase error and the carrier phase error and the carrier frequency error and the state error covariance matrix for providing an error state vector,

navigation calculating a receiver position and a receiver velocity from the error state vector and from the inertial measurement samples,

satellite calculating a satellite position and a satellite velocity from the GPS spread spectrum input signal,

range calculating a pseudorange and a pseudorange rate from the receiver and satellite positions and velocities,

carrier phase adjusting the quadrature demodulation signals from the pseudorange rate for reducing the carrier phase between the carrier and the quadrature demodulation signals for tracking the carrier, and

code phase adjusting the early and late code replicas from the pseudorange for reducing the code phase between the spread spectrum code and early and late code replicas for tracking the spread spectrum code.

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14. The method of claim 13 wherein,

the integrating step further provides clock error estimates, and

the range calculating step calculates the pseudorange and the pseudorange rate from the receiver and satellite positions and velocities and from the clock error estimates.

15. The method of claim 13 wherein the residual generating step and the calculating step and the propagating step and the Riccati estimating step are a Kalman prefiltering process in the GPS spread spectrum receiver.

16. The method of claim 13 wherein,

the state error covariance matrix is a Riccati state error covariance matrix P defined by an algebraic Riccati equation of the form $0=AP+P^TA+W-Ph^TV^{-1}hP$ where A is a state dynamics matrix, V^{-1} is an inverse observation covariance, h is a linearized observation matrix, h^T is a transposed linearized observation matrix, and W is a state covariance.

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